

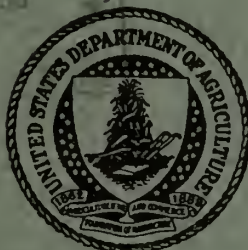
Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Ec 7 Agr
Cap. 6

Agricultural Economics RESEARCH

MAY 2 1958



CONTENTS FOR APRIL 1958

Vol. X, No. 2

Clothing Expenditure Units: A New Time Series	<i>Martin S. Simon</i>	Page 37
Objective Methods in Forecasting Components of Corn Yield	<i>Harold F. Huddleston</i>	49
Book Reviews	<i>Marc Nerlove, Harold F. Breimyer, Robert H. Masucci, Alvin L. Bertrand, and Harry A. Steele</i>	54

UNITED STATES DEPARTMENT OF AGRICULTURE

Agricultural Marketing Service
Agricultural Research Service

Contributors

MARTIN S. SIMON for the last several years has conducted research on the demand for textile fibers and products. Until recently he was with the Cotton and Other Fibers Section in the Statistical and Historical Research Branch, AMS. Last month he joined the research staff of the Connell Rice and Commission Company to be associated with Richard J. Foote, formerly of AMS.

HAROLD F. HUDDLESTON, a mathematical statistician in the Agricultural Estimates Division of AMS, has previously contributed to our pages in reporting on research work on crop yield forecasting.

MARC NERLOVE wrote a critical review of Professor Milton Friedman's *A Theory of the Consumption Function* for our January issue.

HAROLD F. BREIMYER is Head of the Livestock, Fats, and Oils Section, Statistical and Historical Research Branch, AMS.

ROBERT H. MASUCCI is a member of the Farm Income Branch, Agricultural Economics Division, AMS. He is responsible for the development of estimates of farmers' production expenses.

HARRY A. STEELE is Head of the Land and Water Section, Farm Economics Research Division, ARS.

ALVIN L. BERTRAND, a rural sociologist, is on sabbatical leave from Louisiana State University and is serving his year away from academic duties as Head of the Levels of Living Section, Farm Population and Rural Life Branch, AMS. He is the senior author and editor of a textbook, *Rural Sociology—An Analysis of Contemporary Rural Life*, to be published in the fall by McGraw-Hill.

EDITORS: Charles E. Rogers
James P. Cavin

ASSISTANT EDITORS: Raymond P. Christensen
Winn Finner

Clothing Expenditure Units: A New Time Series

By Martin S. Simon

Per capita figures in general permit an assessment of changes in economic quantities and values over time, unobscured by trends in population size. Use of total population as the divisor implicitly assumes that each member of the population has equal importance as a consumer or spender, or that the relative distribution of the various groups in the population remains basically unchanged. For many items, such an assumption can be made, but for others it is not acceptable. Apparel expenditures are a case in point. These expenditures differ markedly by age and sex. And the age-sex composition of the population has changed and is changing. This article presents as a population divisor for apparel expenditures a new series called "clothing expenditure units" and contrasts the results of its use with the traditional approach. Calculation of the new series entailed the application of weights consisting of clothing expenditure relatives by age and sex to population estimates by age and sex. The procedure, including assumptions and source material, is described in detail. For valuable assistance in the development of the conceptual basis of the study and in preparation of the research, the author is indebted to Frank Lowenstein, head of the Cotton and Other Fibers Section of the Statistical and Historical Research Branch, Agricultural Economics Division, AMS.

With concern bordering on despair, producers of apparel products and their raw material suppliers, since the end of World War II, have watched consumers spend an ever smaller part of their disposable income on apparel products. Between 1947 and 1956, the percentage of disposable income allotted to apparel items (excluding footwear) declined from 9.2 to 6.2 percent (table 1). Even after adjusting for the decline in apparel prices relative to all consumer prices during most of this period for which the shift in relative consumer demand away from apparel items is in some part to blame, the fall was still

steep—from 9.1 to 6.8 percent of disposable income. Whether the downtrend is destined to continue—or, more positively, when it will halt or change direction—depends largely on conditions that are responsible for it.

The downtrend manifested itself in a period of sustained prosperity in the United States, and perhaps was symptomatic of it. Between 1947 and 1956, real personal disposable income per capita rose by about 20 percent. During the same period, real per capita expenditures for men's and boys' apparel declined about 11 percent, and those for women's and children's apparel about 4 per-

TABLE 1.—*Consumer expenditures for apparel¹ and personal disposable income: Actual and adjusted for price changes, 1929 to 1956*

Year	Actual			Adjusted for price changes		
	Personal disposable income	Consumer expenditures for apparel		Personal disposable income ²	Consumer expenditures for apparel	
		Total	Percentage of income		Total ³	Percentage of income
	<i>Million dollars</i>	<i>Million dollars</i>	<i>Percent</i>	<i>Million dollars</i>	<i>Million dollars</i>	<i>Percent</i>
1929.....	83, 120	7, 682	9. 24	113, 397	12, 740	11. 23
1930.....	74, 374	6, 659	8. 95	104, 165	11, 306	10. 85
1931.....	63, 840	5, 713	8. 95	98, 215	10, 659	10. 85
1932.....	48, 660	4, 022	8. 27	83, 322	8, 467	10. 16
1933.....	45, 740	3, 731	8. 16	82, 720	8, 129	9. 83
1934.....	51, 980	4, 585	8. 82	90, 874	9, 133	10. 05
1935.....	58, 322	4, 982	8. 54	99, 356	9, 846	9. 91
1936.....	66, 222	5, 403	8. 16	111, 673	10, 594	9. 49
1937.....	71, 000	5, 546	7. 81	115, 635	10, 328	8. 93
1938.....	65, 692	5, 495	8. 36	108, 942	10, 290	9. 45
1939.....	70, 444	5, 893	8. 37	118, 593	11, 225	9. 47
1940.....	76, 076	6, 153	8. 09	127, 005	11, 566	9. 11
1941.....	92, 982	7, 132	7. 67	147, 825	12, 827	8. 68
1942.....	117, 516	8, 537	7. 26	168, 603	13, 154	7. 80
1943.....	133, 547	10, 486	7. 85	180, 469	15, 466	8. 57
1944.....	146, 761	11, 647	7. 94	195, 161	16, 043	8. 22
1945.....	150, 355	13, 109	8. 72	195, 520	17, 181	8. 79
1946.....	159, 182	15, 097	9. 48	190, 866	18, 037	9. 45
1947.....	169, 016	15, 610	9. 24	176, 980	16, 076	9. 08
1948.....	187, 601	16, 450	8. 77	182, 491	15, 894	8. 71
1949.....	188, 157	15, 371	8. 17	184, 830	15, 464	8. 37
1950.....	206, 130	15, 154	7. 35	200, 516	15, 448	7. 70
1951.....	226, 069	16, 086	7. 12	203, 666	15, 048	7. 39
1952.....	237, 374	16, 588	6. 99	209, 140	15, 679	7. 50
1953.....	250, 235	16, 350	6. 53	218, 737	15, 601	7. 13
1954.....	254, 463	16, 117	6. 33	221, 658	15, 453	6. 97
1955.....	270, 189	16, 813	6. 22	235, 973	16, 213	6. 87
1956.....	287, 202	17, 825	6. 21	247, 162	16, 896	6. 84

¹ Clothing and accessories (including luggage but excluding footwear).

² Divided by Bureau of Labor Statistics consumer price index (1947-49=100).

³ Divided by Bureau of Labor Statistics consumer price index for apparel (1947-49=100).

Computed from reports of the Department of Commerce.

cent. These series reached the low point for the post-World War II period in 1954. The percentage decline between 1947 and 1954 was about 16 percent for men and boys and 10 percent for women and children, whereas real disposable income increased about 11 percent.

But this is not the only apparent paradox in the situation. For although real apparel expenditures for women and children per capita have shown a downtrend since 1947, these expenditures have been maintained at a level considerably above those for the prewar period 1929-41. But this was not true of expenditures per capita for men's and boys' apparel—at no time since 1947 have their real apparel expenditures exceeded those in 1929,

and they have been below the 1941 level since 1949.

Many explanations have been advanced for the declining relative importance of apparel in the consumer's budget in the post-World War II period. As the decline occurred in a period of generally rising incomes an economist might accept it as an indication of a relatively inelastic demand with respect to income. Other less technical explanations include: (1) The shift in consumer tastes toward more informal clothing; (2) the failure of the industry to compete with other products from a merchandising or promotional standpoint, including the ready extension of credit; (3) the increased durability of fibers and

fiber products, stemming partly from the rise in the use of man-made fibers; (4) the availability of many more new products and services that compete with apparel for the consumer's dollar; (5) the decline in importance of apparel as a prestige item relative to automobiles and housing; (6) improved heating systems in buildings and in means of transportation; (7) the movement of population to the suburbs, which may account partly for increased informality in dress and the shift in the position of the automobile from a luxury item to almost a necessity; and (8) changes in the age-sex composition of the population.

No doubt the list could be extended. Each factor has probably played a part; some are interrelated. But this article addresses itself to the last factor alone. The aim here is to provide for the apparel industry a population series that is adjusted for changes in age-sex composition from the standpoint of their effect on expenditures for apparel.

The use of total population to convert apparel expenditures to a per capita basis assumes implicitly that each member of the population has equal weight as an apparel expenditure unit. This in fact is an incorrect assumption. There are differences, and important among these differences are those relating to age and sex. The use of total population to obtain per capita figures thus fails to allow for the effect of changes in the age-sex composition of the population on apparel expenditures.

Population Composition and Apparel Expenditures

As indicated previously, a change in the age distribution of the population has been offered as partial explanation of the apparent downtrend in per capita expenditures for apparel since the end of World War II.¹ In this respect two developments have been of primary significance:

(1) Trends in birthrates in the United States, which were downward in the 1920's and 1930's, were upward thereafter. In consequence, the number of children in the population 14 years old and younger declined about 9 percent between 1929 and 1941, whereas the rest of the population (excluding Armed Forces overseas) rose about

17 percent. Between 1941 and 1956, the number of children increased about 53 percent, compared with a 17-percent increase for the age group over 14. Relative to total population, these changes meant a decline in the proportion of the population 14 years and under from 30 percent in 1929 to 25 percent in 1941, followed by a recovery to 30 percent by 1956.

(2) The upward trend in life expectancy continued from 1929 to 1956. The proportion of persons in the population 60 years and over rose from about 8 percent in 1929 to 13 percent in 1956. The proportion of women in this group increased also—from 49 to 53 percent.

These developments affect apparel expenditures because spending on items of clothing differs markedly for individuals of different age and sex. Specifically, the proportion of low spenders for clothing in the economy has increased. For example, the average clothing expenditure of husbands and wives 60 years of age and over in Minneapolis-St. Paul in 1948-49 was about on a par with that of children in the 6 to 11 age group. It was considerably below that for other adults and for children 12 years of age and older. Inventories also declined with increasing age, but to a lesser extent than expenditures.²

Quantitative information as to the extent of differences in clothing expenditures by age and sex is given in varying detail in several cross-section studies. Differences are large. Data reported by the National Resources Planning Board (11) on average clothing expenditures per family member show expenditures by men (16 years and over) to be 2.5 times that for boys (2 to 15 years old). A similar relationship held between women and girls—average expenditures for both exceeded that for their male counterparts by about 15 and 5 percent, respectively. To ignore these differences could be a serious oversight, particularly in light of the shifts in the composition of the population that have occurred.

Cohen (2) attempted to account for the effect of changes in the composition of the population on apparel expenditures by introducing in a regression analysis as separate variables (1) population under age 14 and (2) civilian population 14 years and over. His results show that, for the period 1923-41, with other things the same, an increase of 1 percent in the population under 14 years of age

¹ For example, see Cohen (2, p. 167). Numbers in italics in parentheses refer to Literature Cited, page 48.

² See Brew, O'Leary, and Dean (1, pp. 11-15).

was associated with a *decrease* of 0.09 percent in total real clothing expenditures, whereas an increase of 1 percent in the civilian population 14 years of age and over was associated with a 1.13-percent *increase* in expenditure.

Calculation of Clothing Expenditure Units

By development and use of specially weighted population aggregates we can adjust for the effect of changes in the age-sex structure of the population on apparel expenditures. That is the approach taken here. The primary basis for the weights was provided by Williams and Hanson (12) in data on relative expenditures for clothing by persons of different age, sex, and occupation. These data were particularly useful because of the comprehensive breakdown in age, which covered 16 groups, from children under 2 to adults 60 and over. The data were obtained originally in connection with a study of money disbursements of families of wage earners and clerical workers living in large cities in the United States in 1934-36.

In the calculation of clothing expenditures by age, sex, and occupation in the Williams and Hanson study, family size and income are held constant. The average annual expenditure of each class for clothing is given as a percentage of the average expenditure of white male wage earners and clerical workers, 21 through 35 years of age, which is \$56.68. The expenditure for the latter group is taken as a single clothing expenditure unit. Thus, application of the clothing expenditure relatives to corresponding population breakdowns by age group results in a weighted aggregate which, for each year, is the sum of clothing expenditure units as defined. In effect, it is population adjusted for changes in age-sex composition. The clothing expenditure units may also be regarded as equivalent male adults.

An example may clarify the procedure. Table 6 shows the clothing expenditure relatives used to weight population by age and sex. Multiplying the number of people in each age group by the appropriate relative and summing over the age groups gives the clothing expenditure units. In order to compare the sum of the clothing expenditure units with the number in the population in absolute terms, the sum of the clothing expenditure units can be multiplied by an adjustment factor which consists of the ratio of the number of age groups to the sum of the relatives

for the corresponding age groups. In the case of males 5 years of age and over, this procedure results in 69.9 million clothing expenditure units in 1956 compared with a population total of 72.9 million. As 12 age groups were involved (table 6), the adjustment factor took the form of the ratio of 12 to 9.28 (the sum of the clothing expenditure relatives for the 12 age groups). In effect, this adjusts the clothing expenditure relatives to a level comparable to the implicit unit weights of the population series.

Table 2 gives the corresponding series on clothing expenditure units and population by sex for the years 1929-41 and 1947-56. Figure 1 shows real apparel expenditures by sex for the same years on a per capita basis and in terms of clothing expenditure units. To facilitate comparisons, data in table 2 and figure 1 are shown on a 1929 base. Assumptions and methodological details relating to the use of the Williams and Hanson data and other survey information in the construction of these series are given in a later section.

Population and Clothing Expenditure Units

Figure 1 indicates that the use of population adjusted for changes in age-sex distribution, as represented by the series on clothing expenditure units, has a decided bearing on the level and trend of apparel expenditures per person. This is particularly true of expenditures for women's and children's apparel, largely because of the addition of males under 5 to the children's group.³

The index numbers of real apparel expenditures for men and boys per capita and per clothing expenditure unit show almost identical movements during 1929-41. Roughly offsetting changes in the proportion of children (5 to 14 years of age) and of relatively low spenders for clothing among the adults, particularly the 50 and over age group, were primarily responsible for this development. During 1947-56, both of these age groups increased in size relative to the total. In consequence, the number of males in the population 5 years old and

³ Information obtained from representatives of the United States Department of Commerce led to the conclusion that expenditures for children's clothing would include that for clothing for male youngsters through about size 5. For this reason, males under 5 are included with females in adjusting the women's and children's expenditure series for changes in population size and age composition.

TABLE 2.—*Population and clothing expenditure units by sex: Index numbers, United States, 1929-41 and 1947-56*

[1929=100]

Year	Population ¹			Clothing expenditure units ^{1 3}		
	Men and boys	Women and children ²	Total	Men and boys	Women and children ²	Total
1929.....	100	100	100	100	100	100
1930.....	101	101	101	101	101	101
1931.....	102	101	102	102	102	102
1932.....	103	102	103	103	103	103
1933.....	104	102	103	104	104	104
1934.....	105	103	104	105	105	105
1935.....	106	103	105	106	105	106
1936.....	107	104	105	107	106	106
1937.....	107	105	106	107	107	107
1938.....	108	106	107	108	108	108
1939.....	108	107	107	109	109	109
1940.....	109	108	108	109	110	110
1941.....	110	109	109	110	111	111
1947.....	115	120	118	114	119	117
1948.....	117	123	120	116	120	118
1949.....	118	125	122	117	122	120
1950.....	120	128	124	118	123	121
1951.....	120	131	126	118	125	122
1952.....	122	133	128	119	126	123
1953.....	124	135	130	120	128	125
1954.....	126	138	132	122	130	126
1955.....	129	140	135	124	131	128
1956.....	131	143	137	126	133	130

¹ Estimates as of July 1 excluding Armed Forces overseas.

² Includes male children under 5.

³ Population adjusted for changes in age-sex composition. Each unit is equivalent to the average annual clothing expenditure of \$56.68 by white male wage earners

and clerical workers, 21 through 35 years of age, in 1934-36.

Population series from reports of the Bureau of the Census. Clothing expenditure units computed from data given in Williams and Hanson (12) following the procedure described in the text.

over rose faster than the number of clothing expenditure units they represented (table 2). The effect of this divergence on apparel expenditures per person is shown in figure 1.

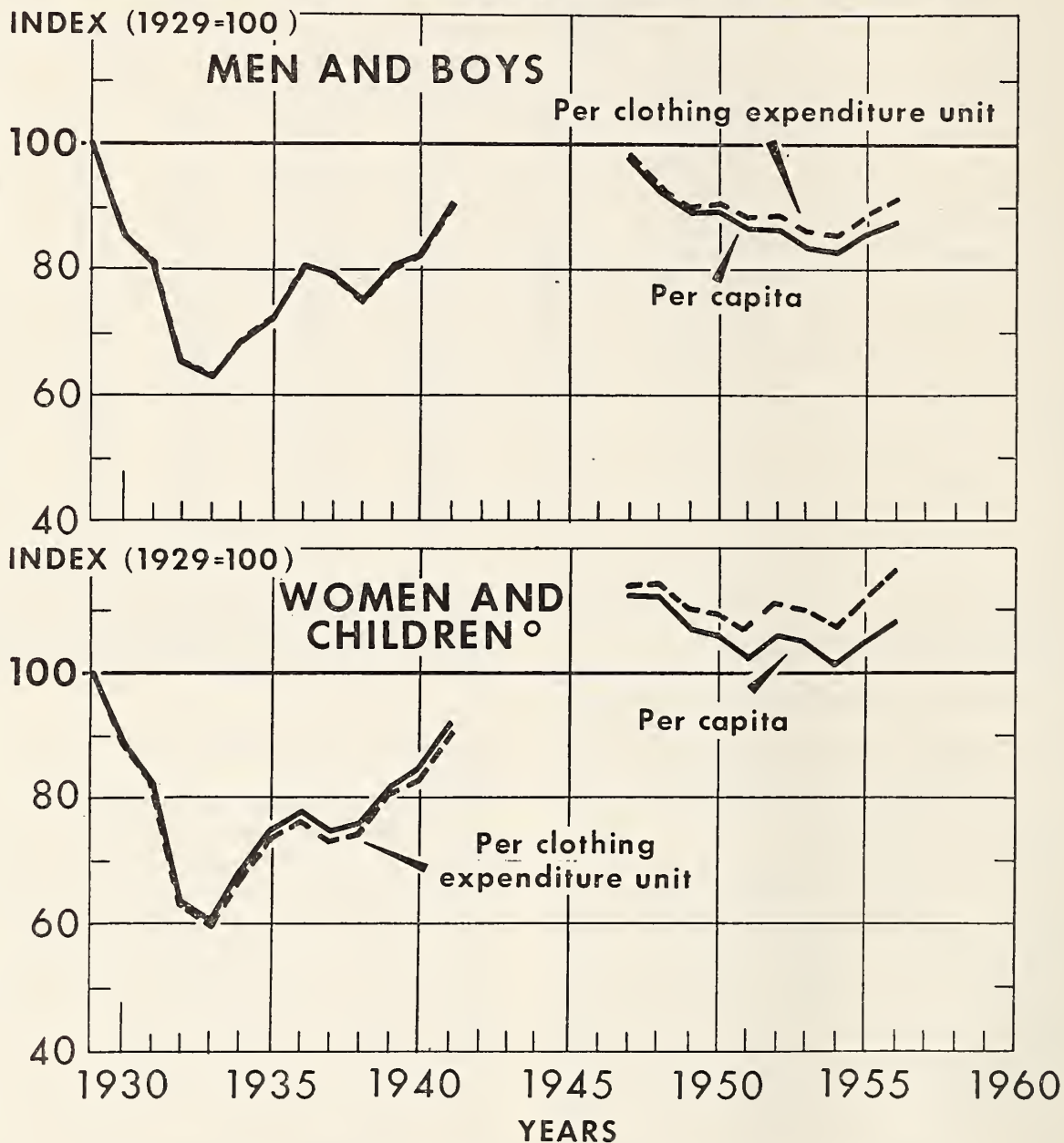
For the index numbers that relate to expenditures for women's and children's apparel, differences are somewhat more pronounced, reflecting primarily the inclusion of children of both sexes under 5 years of age. Thus, during 1929-41, the number of clothing expenditure units for women and children rose faster than the number of women and children, as increases in the proportion of older female adults in the total population failed to compensate for decreases in the children's proportion. Both of these groups, as for the men and boys, increased during 1947-56, with the result that the increase in clothing expenditure units was much less than the increase in the number of women and children in the population. Figure 1 shows the effect on expenditures for women's and children's clothing per per-

son of the alternative adjustments for population changes.

Effects of adjustment for changes in the age-sex composition of the population described above may be understated. This is due to the fact that the clothing expenditure relatives, which were used as weights for the population adjustment, differ in terms of coverage from the time series on aggregate apparel expenditures, for which the adjusted population series were developed. The former include expenditures for shoes, the latter do not—this is the most important difference.

As expenditures for shoes absorb a larger proportion of the total spending for clothing for children than for adults, it follows that the weights used for the children from the standpoint of their applicability to the apparel expenditure time series are too large. Adjustment for this factor would reduce the number of clothing expenditure units in the population.

REAL APPAREL EXPENDITURE PER CAPITA AND PER CLOTHING EXPENDITURE UNIT* BY SEX



*EQUIVALENT TO AVERAGE ANNUAL EXPENDITURES IN 1934-36 OF \$56.68 FOR AN EMPLOYED MALE ADULT 21-35 YEARS OF AGE

^oINCLUDES MALE CHILDREN UNDER 5 YEARS OF AGE

FIGURE 1.

Some idea of the degree of error can be obtained from expenditure studies that provide product detail. Thus, in a study reported by the Bureau of Labor Statistics (4), the proportion of clothing expenditure accounted for by footwear in 1941 was 27 and 23 percent, respectively, for boys and girls (2 to 15 years of age) compared with percentages of 14 and 16, respectively, for men and women (16 years and over).

A partial offset to the foregoing discrepancy is provided by other differences in coverage, particularly those relating to expenditures for clothing upkeep, such as cleaning and repairing, and for jewelry. Spending for these items is included in the clothing expenditure relatives but not in the apparel expenditure time series. In the study cited (4), expenditures for these items accounted for 10 percent of the total clothing expenditures by men and boys (16 years and over), 7 percent of those by women and girls (16 years and over), and 5 percent each of those for boys and girls (2 to 16 years of age). Because of the partial offset and because the necessary data are limited, no attempt was made to adjust for the several inconsistencies in coverage, but they should be borne in mind when interpreting results.

Projections

The Bureau of the Census periodically publishes projections of the population of the United States by age and sex for a certain period in the future. These projections are based on assumed levels of fertility, mortality, and net immigration. Several alternative projections are generally given. These are based on alternative assumptions as to future levels of fertility. The most recent projections were published by the Bureau (9) in October 1955. They are undergoing revisions that are expected to be available in the near future.

The "high" 1955 projections of population by age and sex were used to calculate clothing expenditure units in order to provide some indication of the future relationship between these units and population. The results of these calculations are given in table 3 in the form of index numbers based on 1955. These data are not exactly comparable with the estimates given in table 2 for 1929 to 1956 because of (1) the inclusion of members of the Armed Forces overseas

and (2) slight revisions in the actual estimate for 1955. However, the differences are probably of little consequence.

As is apparent from table 3, based on present high projections of future population, the rate of growth in population and in clothing expenditure units between 1955 and 1975 is expected to be roughly similar. For men and boys, based on the "AA" projection series,⁴ the rate of increase in clothing expenditure units from 1955 catches up with population by 1970; based on the "A" series,⁵ it passes population by 1970. For women and children, based on both series, the rate of increase in clothing expenditure units from 1955 stays fairly close to that of population but never quite catches up.

In terms of the 1929 base (table 2), the projections indicate that the disparity that developed between population and clothing expenditure units between 1929 and 1955 will tend to persist, with some variation, during the next 20 years or so. In the case of men and boys, the difference between the series will tend to widen until 1960 or 1965 (depending on the projection series) and then narrow somewhat over the ensuing decade, ending up about the same as at present. For women and children (including males under 5 years of age), the disparity will continue to widen during the next two decades, but at a somewhat reduced rate, particularly until 1970.

In evaluating these projections, several points should be borne in mind. In the first place, census projections are based on certain assumptions with respect to the determinants of population growths. If these assumptions turn out to be incorrect, the projections of population and, of course those of clothing expenditure units, will prove incorrect also. As already stated, the Bureau of the Census is now revising its projections. Second, in the foregoing calculations only the high projections were used; in light of recent developments they appeared to be more reasonable than the lower ones. But they may still be too high. And, to mention a third point, though the projections are useful indicators of probable future

⁴ Assumed that the 1954-55 level of fertility would continue to 1975.

⁵ Assumed that the 1950-53 level of fertility would continue to 1975.

TABLE 3.—*Projections of population and clothing expenditure units by sex: Index numbers, United States, 1960 to 1975*

[1955=100]

Year	Population ¹						Clothing expenditure units ^{1 5}					
	Men and boys		Women and children ⁴		Total		Men and boys		Women and children ⁴		Total	
	AA ²	A ³	AA ²	A ³	AA ²	A ³	AA ²	A ³	AA ²	A ³	AA ²	A ³
1960.....	108	108	109	107	109	108	107	107	107	107	107	107
1965.....	117	116	117	115	117	115	116	115	116	115	116	115
1970.....	126	124	127	124	127	124	126	124	126	124	126	124
1975.....	136	133	140	135	138	134	137	134	138	134	137	134

¹ Estimates as of July 1 including Armed Forces overseas.

² Assumes 1954-55 level of fertility continues to 1975.

³ Assumes 1950-53 level of fertility continues to 1975.

⁴ Includes male children under 5 years of age.

⁵ Population adjusted for changes in age-sex composition. Each unit is equivalent to the average annual

clothing expenditure of white male wage earners and clerical workers, 21 through 35 years of age, in 1934-36 of \$56.68.

Population series computed from Bureau of the Census (9). Clothing expenditure units computed from data given in Williams and Hanson (12) following the procedure described in the text.

growth of population, in view of the foregoing they should be interpreted with caution.

The most important of the changes within the population aggregate that bear on aggregate apparel expenditures are those in age-sex composition, but they are not the only ones. Others that may be included are: (1) Historic shifts in the proportion of women in the population in the labor force; (2) rural-urban migration; (3) urban-suburban migration; (4) trends in family size; (5) changes in marital status; (6) in type of occupation, and (7) in geographic location.

Methodology

Details of the method used to convert population to an equivalent basis from the standpoint of individual apparel expenditures are given in the paragraphs that follow.

The initial requirement is information on apparel purchases by age and sex. Information is available from several sources, but none of it fully represents the age-sex composition of the entire population. All cross-section studies reviewed for this purpose have limitations. For some, the age breakdown is too broad, being limited essentially to a distinction between adults and children. For others, for which a more detailed age breakdown is given, there are problems of restricted coverage.

For example, Brew, O'Leary, and Dean (1) give age-expenditure and age-inventory detail for

white families consisting of a husband and wife and no more than two dependent children, 2 to 15 years of age, living in Minneapolis-St. Paul and Meeker and Wright Counties, Minnesota, in 1948-50. There are three age breakdowns for children—2 to 5 years, 6 to 11 years, and 12 to 15 years—and five for parents—under 30, 30 to 39, 40 to 49, 50 to 59, and 60 and over. Single individuals over 16 years of age, whether or not they are members of a family, and infants are not included. The study is limited in geographical coverage.

In another study, conducted by the U. S. Bureau of Labor Statistics (3), expenditures for clothing for family members other than husband and wife are given for the following age breakdowns: (1) 2 to 5 years; (2) 6 to 11 years; (3) 12 to 15 years; (4) 16 to 29 years; and (5) 30 years and over. No age breakdown is given for husbands and wives. Data are shown separately by income class, color, geographic area, and family size. The survey was conducted in 1936 by the Bureau of Labor Statistics in selected cities in different regions of the country.

The most comprehensive sex-age breakdown of clothing expenditures is given by Williams and Hanson (12). This is a study of money receipts and disbursements of wage earners and salaried workers covering 12 months within the period 1934-36 in 42 cities in the United States, each with population over 50,000. Like the source

TABLE 4.—*Relative clothing expenditures for persons of different age, sex, and occupation*¹
 [Ratio to the \$56.68 annual expenditure of male wage earners and clerical workers aged 21 and under 36]

Age	Male				Female			
	Under 5 and at school	At home	Clerical	Wage earner	Under 5 and at school	At home	Clerical	Wage earner
<i>Years</i>								
Under 2	0. 19				0. 19			
2 and under 6	. 34				. 38			
6 and under 9	. 48				. 47			
9 and under 12	. 53				. 56			
12 and under 15	. 63				. 77			
15 and under 18	. 88	0. 74	1. 02	1. 02	1. 01	0. 94	1. 08	1. 08
18 and under 21	1. 01	. 80	1. 14	1. 13	1. 28	1. 05	1. 60	1. 63
21 and under 24		. 57	1. 14	1. 07		1. 04	1. 66	1. 60
24 and under 27		. 48	1. 13	1. 00		1. 02	1. 64	1. 46
27 and under 30		. 46	1. 10	. 96		1. 00	1. 62	1. 36
30 and under 36		. 44	1. 04	. 92		. 96	1. 58	1. 23
36 and under 42		. 43	. 94	. 87		. 88	1. 48	1. 07
42 and under 48		. 41	. 87	. 81		. 78	1. 35	. 94
48 and under 54		. 39	. 80	. 75		. 68	1. 18	. 84
54 and under 60		. 37	. 75	. 69		. 58	1. 03	. 76
60 and over		. 35	. 65	. 60		. 40	. 78	. 67

¹ Data based on white families in 42 cities combined.
 Reproduced in essence from Williams and Hanson (12, p. 364).

quoted in the last paragraph, this study was conducted under the auspices of the Bureau of Labor Statistics. It was undertaken for the primary purpose of up-dating the weights used in the Bureau's cost-of-living indexes. The families included in the study had to meet the following criteria (12, p. 1): "Family incomes of at least \$500 per year; no receipt of relief, either direct or work relief, during the survey year; at least one earner employed for 36 weeks and earning at least \$300; no clerical worker earning over \$200 per month or \$2,000 per year."

In this study, clothing expenditures are shown for 16 age breakdowns from children under 2 years of age to adults 60 and over by sex and activity. The following activity for each sex is recorded: (1) Children under 5 and at school; (2) persons at home; (3) wage earners; and (4) clerical workers. Expenditures for each group are expressed as relatives to the annual average expenditure of \$56.68 of male wage earners and clerical workers, 21 through 35 years of age. The data for each group represent composite averages covering approximately 10,000 white families and are adjusted for differences in family size and income.⁶ The series on relative clothing expendi-

tures by age, sex, and occupation are reproduced in table 4.

Although limited in the sense that they apply directly to only a part of the population, the clothing expenditure relatives shown in table 4 appear to be best suited for the purpose at hand. In their use, the assumption is made that they can be regarded as representative of the population as a whole. The reasonableness of this assumption was checked by comparing appropriate recombinations of the expenditure relatives with those calculated from other studies for which population representation was broader but age detail was more restricted. On the whole, the comparisons tend to confirm the validity of the assumption (see p. 47).

Calculation of the Weights

The following rough adjustments were made in the expenditure relatives before they were used as weights in the conversion of population to equivalent clothing-expenditure units: (1) A single continuous series for males and for females was obtained by abstracting from the activity differences by age and sex. (2) The age breakdowns were regrouped to conform to the age breakdowns of the published population estimates. As a first step, estimates of the clothing expenditure relatives by single years of age were obtained

⁶ The average income of the white families was \$1,546 and the average family included 3.6 persons.

by interpolation between the age group averages given in table 4.

The major difference among the four activities for which data are available is one of level. As table 4 shows, for most of the adult age span, the relative clothing expenditures of clerical workers is highest, followed in order by wage earners, children under 5 and at school (for the ages for which they overlap the other groups, 15 through 20), and persons at home. This holds for both males and females.

The shape of the curves for the employed adults over the age span is, in the main, similar, rising to a peak in the late teens and early 20's and declining thereafter. Except for female wage earners, the decline is gradual. Expenditures for persons at home also rise to a peak in the late teens and early 20's and then decline over the entire age span. For men at home, the initial decline is relatively sharp but after the middle 20's it tapers off at a moderate rate. Expenditures for children rise steadily and at a relatively rapid rate.

The expenditure relatives for male and female clerical workers were taken to represent the expenditure pattern by age of the entire working population in the United States. The selection was based on the assumption that the age-expenditure pattern of omitted groups tend to *average* somewhat higher in level than the patterns of either wage earners or clerical workers, thus offsetting the fact that expenditures by wage earners are lower than those made by clerical workers. The omitted groups include single consumers regardless of occupation, business and professional workers, and persons living on farms.

The next step was to combine the expenditure relatives for the groups in clerical occupations, at home, and in school into a single series for each sex. Weights were computed for this purpose from information on the employment status of the population given in the 1940 Census of Population (5, 6). These weights consist of the percentage of the population 14 years of age and older employed, the percentage in school, and the percentage not in school and not employed, whether for reasons of unemployment, housekeeping, inability to work because of illness or disability, or retirement. The percentage not in school and not employed was used to represent the "at home" group. The 1940

census was chosen because of the pertinent information it provides on employment status and its relative proximity in time to the expenditure survey.

The employment-status weights were available for 19 relevant age breakdowns, and included single years of age for the age group 14 to 24 and 5-year age groups from 25 to 60 and over. These are shown by sex in table 5. By linear interpolation, single years of age were estimated for the employment-status percentages for the 25 to 59 year age group. The percentages by single years of age were then used to effect the combination of the three series on clothing expenditure relatives into a single one covering the full age span.

TABLE 5.—*Employment status of the population 14 years of age and over: Percentage distribution by age and sex, United States, 1940*

Age	Male			Female		
	Em- ployed	In school ¹	At home ²	Em- ployed	In school ¹	At home ²
Years	Per- cent	Per- cent	Per- cent	Per- cent	Per- cent	Per- cent
14-----	5	83	12	1	85	14
15-----	9	79	12	2	82	16
16-----	15	68	17	5	71	24
17-----	23	54	23	10	57	33
18-----	38	34	28	23	31	46
19-----	51	20	29	33	17	50
20-----	60	12	28	37	9	54
21-----	67	8	25	39	6	55
22-----	72	6	22	40	3	57
23-----	75	4	21	38	2	60
24-----	78	2	20	36	1	63
25-29----	82	1	17	32	(3)	68
30-34----	85	(3)	15	28	(3)	72
35-39----	84	(3)	16	25	(3)	75
40-44----	83	(3)	17	23	(3)	77
45-49----	81	(3)	19	21	(3)	79
50-54----	79	(3)	21	18	(3)	82
55-59----	74	(3)	26	16	(3)	84
60 and over	48	(3)	52	8	(3)	92
Average--	67	9	24	22	9	69

¹ Estimated from a 5-percent sample. See U. S. Bureau of the Census (5).

² Includes those seeking work, on public emergency work, engaged in housekeeping, unable to work, in institutions, retired, etc.

³ Less than 0.5 percent.

Compiled from U. S. Bureau of the Census (6, p. 90) and (5, pp. 17, 31).

Published estimates of the population of the United States by age and sex on an annual basis are given primarily in 5-year age groups (7, 8, 10). In only a few instances do these groups correspond

to those of the clothing expenditure relatives as originally given (see table 4). Correspondence was effected as follows: A breakdown of the population of the United States by single years of age was obtained from the 1940 census (6). Using these data as weights, the estimates of the combined series of clothing expenditure relatives by single years of age were regrouped to correspond to the usual 5-year age groups of the annual population estimates. Table 6 gives the results of these calculations. The regrouped clothing expenditure relatives were used to estimate the number of clothing expenditure units in the population as of July 1 for each year from 1929 to 1956. These are shown in index number form in table 2.

Final Evaluation

In evaluating final results, the data and assumptions should be kept clearly in mind. The final set of weights are based on limited information; they required various adjustments, some necessarily rough. The clothing expenditure relatives apply directly to only a part of the population at a specific period of time. When alternative information or procedures were available, the selection was made primarily on the basis of personal judgment. Obviously, the results depend on the particular choices made. The final series is believed to be an acceptable one, but others might be equally acceptable.

As noted earlier, in an attempt to obtain confirmation for the assumption that the clothing expenditure relatives given in Williams and Hanson (12), as adjusted, can be taken as representative of the age-expenditure pattern of consumers in the United States over time, comparisons were made, to the extent possible, with information from other studies. In general, comparisons were favorable to the assumption. For example, the usual ranking in order of importance in clothing expenditure for adults and children by sex is as follows: (1) Female adults; (2) male adults; (3) female children; (4) male children; and (5) infants (children under two). The adjusted clothing expenditure relatives conform to this ranking.

In addition, relative differences in the magnitude of expenditures at the adult level and separately for the children appear to be consistent. This does not hold, however, for differences between the two groups by sex. Thus, on the basis

TABLE 6.—*Clothing expenditure relatives used to weight population by age and sex*

Age	Male	Female
<i>Years</i>		
Under 5-----	0. 27	0. 29
5-9-----	. 47	. 47
10-14-----	. 60	. 70
15-19-----	. 93	1. 10
20-24-----	1. 02	1. 29
25-29-----	1. 00	1. 21
30-34-----	. 95	1. 14
35-39-----	. 88	1. 05
40-44-----	. 82	. 96
45-49-----	. 76	. 85
50-54-----	. 71	. 75
55-59-----	. 65	. 64
60 and over-----	. 49	. 43

Computed from data given in Williams and Hanson (12) and adjusted as described on pp. 44-47.

of the adjusted clothing expenditure relatives, expenditures for clothing for children (2 to 15 years of age) are slightly more than 60 percent of those of their adult counterparts. Information from other surveys, however, tends to show a smaller percentage relationship. A comprehensive study reported by the United States National Resources Planning Board (11) shows that average clothing expenditures per person for boys and girls (2 to 15 years of age) in 1935-36 were about 41 and 38 percent, respectively, of those of men and women (16 years and over). In a nationwide study of family expenditures in 1941 (4), this percentage was computed to be about 45 percent for both sexes.

This difference in the magnitude of the relationship between adults and children may reflect in part the fact that calculation of the original clothing expenditure relatives by age and sex (see table 4) was made with family income and family size held constant. Using unadjusted data from Williams and Hanson (12), average clothing expenditures per person for boys 2 to 17 years of age were estimated to be 55 percent of those for men 18 years and over, and for girls 50 percent of those of women. The corresponding percentage for the adjusted data was 70 percent for both sexes. Other factors that may account for the differences in magnitude include differences in the coverage of the several surveys and the use of information from the 1940 Census of Population for combining and adjusting the clothing expenditure relatives.

Some consideration was given to development of a separate set of weights or clothing expenditure relatives for the post-World War II period, using primarily data reported by Brew, O'Leary, and Dean (1). This was abandoned because of (1) the limited coverage of this survey and (2) the fact that more similarities than differences were found with the expenditure weights calculated from the data in Williams and Hanson (12).

Literature Cited

- (1) BREW, MARGARET L., O'LEARY, ROXANNE R., AND DEAN, LUCILLE C.

1956. FAMILY CLOTHING INVENTORIES AND PURCHASES . . . WITH AN ANALYSIS TO SHOW FACTORS AFFECTING CONSUMPTION. U. S. Dept. Agr. Agr. Inform. Bull. 148, 175 pp.

- (2) COHEN, MORRIS

1955. TEXTILE TRENDS: LONG AND SHORT MODELS. BUSINESS RECORD. 12:164-168, illus. New York, National Industrial Conference Board.

- (3) UNITED STATES BUREAU OF LABOR STATISTICS

1941. FAMILY EXPENDITURES IN SELECTED CITIES, 1935-36. VOLUME III. CLOTHING AND PERSONAL CARE. U. S. Bur. Labor Statis. Bull. 648, 578 pp., illus.

- (4) ———

1945. FAMILY SPENDING AND SAVING IN WARTIME. U. S. Bur. Labor Statis. Bull. 822, 218 pp., illus.

- (5) UNITED STATES BUREAU OF THE CENSUS

1943. POPULATION CHARACTERISTICS OF PERSONS NOT IN THE LABOR FORCE 14 YEARS OLD AND OVER. 117 pp., illus. [From the 16th Census of the U. S., 1940.] Washington.

- (6) ———

1943. [U. S.] CENSUS OF POPULATION: 1940. VOLUME IV, CHARACTERISTICS BY AGE;

PART 1, UNITED STATES SUMMARY. 183 pp., illus. Washington.

- (7) UNITED STATES BUREAU OF THE CENSUS

1954. ESTIMATES OF THE POPULATION OF THE UNITED STATES AND OF THE COMPONENTS OF CHANGE, BY AGE, COLOR, AND SEX: 1940 TO 1950. U. S. Bur. Census. Current Population Rpts.; Population Estimates, Ser. P-25, No. 98, 20 pp. [Processed.]

- (8) ———

1955. ESTIMATES OF THE POPULATION OF THE UNITED STATES, BY AGE, COLOR, AND SEX: 1900 TO 1940. U. S. Bur. Census Current Population Rpts.; Population Estimates, Ser. P-25, No. 114, 11 pp. [Processed.]

- (9) ———

1955. REVISED PROJECTIONS OF THE POPULATION OF THE UNITED STATES, BY AGE AND SEX: 1960 TO 1975. U. S. Bur. Census Current Population Rpts.; Population Estimates, Ser. P-25, No. 123, 10 pp., illus. [Processed.]

- (10) ———

1956. ESTIMATES OF THE POPULATION OF THE UNITED STATES, BY AGE, COLOR, AND SEX: JULY 1, 1950 TO 1956. U. S. Bur. Census Current Population Rpts.; Population Estimates, Ser. P-25, No. 146, 17 pp., illus. [Processed.]

- (11) UNITED STATES NATIONAL RESOURCES PLANNING BOARD.

1941. FAMILY EXPENDITURES IN THE UNITED STATES. 209 pp., illus. Washington.

- (12) WILLIAMS, FAITH M., AND HANSON, ALICE C.

1941. MONEY DISBURSEMENTS OF WAGE EARNERS AND CLERICAL WORKERS, 1934-36. U. S. Bur. Labor Statis. Bull. 638, 402 pp., illus.

Objective Methods In Forecasting Components of Corn Yield

By Harold F. Huddleston

As part of its research program during the last 4 years, the Agricultural Estimates Division, AMS, has conducted extensive studies on objective yield forecasting methods for several important field crops. Some results of these studies on cotton in the South and on soybeans in the North Central States have been reported in earlier issues. Results of the studies on corn reported in this paper are based on data for 4 years in the South and for 2 years in the North Central States, together with data from a project that has been conducted in cooperation with Iowa State College for several years.

This report summarizes results obtained from objective corn yield forecasting studies conducted in the South and in the North Central States. The data were collected in probability samples of fields in the two regions for a 4-year period—1954–57.

The 1954 sample consisted of 200 fields in 10 Southern States. This was increased to 400 fields in 1955 and to 600 in 1956 and 1957. In 1956, 600 fields in 11 North Central States, Kentucky, and Virginia were added to the program. These were also covered in 1957.

The statistical reliability of the data can be appraised in a general way from the field-to-field sampling variation of ripe ear weight in the sample plots used for plant observations. That variability is about 80 percent on a per field basis. This means that the sampling error in a per field average derived from a sample, even as small as 200 fields, should be only $80/\sqrt{200}$, or less than 6 percent. Of course, the sampling error in the observed data is only one component of the possible error in a yield forecast derived from these data.

Although the same general principles apply in both regions of the country, the practical problem of forecasting yields as of any given forecast date is somewhat different in the South from that in the North Central area, because the crop is in a more advanced stage of development in most of the South. The development of objective yield forecasting formulas that apply to official crop forecast dates must rest upon observable plant characteristics and sufficient knowledge of the fruiting behavior of the plant so that plant characteristics observed on any date can be translated into an indication of yield. The studies reported

here relate to the forecast dates August 1, September 1, and October 1. Field observations, in each instance, were taken during the previous week.

Early in the season, ears or ear shoots that may already be present can be counted in sample plots in sample fields. But when counts are made before all "ears" have had time to emerge, other observable plant characteristics must be used.

As the crop approaches maturity, some ears have attained their maximum length so that the average size of the ears that will be harvested can be ascertained by direct measurement. The average quantity of ripe grain that will be produced per ear is closely related to average length of ear at maturity. Maximum ear length is attained before the grain is ripe. In order to ascertain whether an ear has reached its maximum length on a given forecast date, the stage of maturity of the ear must be considered. Numerous studies on corn, including those made in the present program, show that ears in the milk stage have reached their maximum length. Consequently, measurements of ears in the milk stage were used to forecast the average size of ear at harvesttime.

When corn is already ripe on a forecast date, sample ears can be harvested, weighed, and subjected to laboratory analysis to compute the average weight of grain per ear at a standard moisture content.

As of August 1, all "ears" have not yet appeared in the two regions as a whole. An August 1 yield forecast must first provide a forecast of the number of ears that will be present at harvesttime. It is also necessary to forecast the quantity of grain that will be produced per ear.

By September 1, all ears that have a chance of reaching maturity are present and most are well developed. But in many places even corn that looks ripe has not yet laid down all of the dry matter in the grain. As a kernel of grain ripens, the weight of the total dry matter in the kernel increases. This weight levels off at a maximum when the moisture content of the kernel reaches 30 percent.

By October 1, practically all ears have attained the dry-matter content of grain that can be expected at harvest, except in the very latest maturing fields. In parts of the Northern States, such as Minnesota, Wisconsin, and Michigan, the accumulation of dry matter may be stopped by killing frost before the full yield potential is realized. If frost occurs late enough, the ears may still be harvested for grain, but the grain will be lighter than if development had not been arrested. If frost occurs earlier, the ears may be so immature that the crop must be diverted to uses other than harvest as grain. If this occurs, the contribution of these ears to the total yield of grain may be zero. This is customarily described as the "soft-corn" problem.

Pertinent Relationships for the August 1 Yield Forecast

The forecast of number of ears to be produced is considered first. An observable ear or ear shoot is defined as one that has already developed, at least to the stage at which some silks are protruding from the husk. As of August 1, practically all ears or ear shoots that have a chance of maturing are already present on the plants in most of the South. In a few borderline Southern States, and in the North Central States, the ears and ear shoots present are less than the number that will be found at maturity. It is these areas that require our attention first.

The plant observations are made in two double 15-foot row sections in each sample field. If some of the ears in these small plots have already reached the milk stage, there is little chance of any additional ears appearing later. The ear count represents all ears that will be formed. But if no ears have yet reached the milk stage, the total number of ears to be formed must be forecast. Two methods of making this forecast are currently under investigation.

TABLE 1.—*Number of mature ears produced per 60 feet of row, in relation to August 1 stalk count*

August 1 stalk count	Mature ears produced	August 1 stalk count	Mature ears produced
10.....	10	45.....	45
15.....	16	50.....	50
20.....	21	55.....	55
25.....	26	60.....	59
30.....	31	65.....	64
35.....	36	70.....	68
40.....	41		

The first approach involves counting the stalks in the measured plots and assuming a constant number of ears per stalk from year to year. The second approach assumes a fixed linear relationship between the fraction of stalks with ears on August 1 and the ratio of ears already present to the total number of mature ears that will be produced. No conclusion has been reached as to which of these two approaches is the better. They have given about the same results and the same relationships appear to hold in both the South and the North Central States. The second procedure would be preferable if the number of ears produced per stalk were subject to greater variation from year to year than experience to date indicates.

Data collected during the last several years show that the number of mature ears produced in 60 feet of a row is related to the August 1 stalk count, as shown in table 1. The data in this and subsequent tables are based on free-hand charts drawn on scatter diagrams in which the original data and group averages were plotted.

On the average, about 1.05 mature ears are produced in the South for each stalk counted on August 1. In the North Central States, where yields are higher, the average is 0.98. This difference is not inconsistent with the relationship in table 1, which holds for both regions. When the average stalk count is low, the average number of ears per stalk is greater than unity, and vice versa. The average stalk count is lower in the South than in the North Central region.

Stalks with 2 ears occur more frequently in the South. But field-to-field variation in the number of ears produced per stalk is generally greater. The greater frequency of 2-ear stalks in the South

TABLE 2.—*Ratio of "ears" counted August 1 to mature ears produced, in relation to fraction of stalks with "ears" on August 1, North Central States, and Kentucky and Virginia*

Stalks with "ears", August 1	Ratio of August 1 "ear" count to mature ears produced	Stalks with "ears", August 1	Ratio of August 1 "ear" count to mature ears produced
<i>Percent</i>		<i>Percent</i>	
5.....	10	60.....	87
10.....	23	70.....	100
20.....	36	80.....	114
30.....	49	90.....	127
40.....	62	100.....	140
50.....	74		

is largely nullified by fields that produce less than 1 ear per stalk.

When the fraction of stalks that have ears or ear shoots on August 1 is used to forecast the number of mature ears that will be produced, relationships in the South differ somewhat from those in the North Central region. The ratio of ears and ear shoots counted on August 1 in the South to mature ears produced is about 1.4 times the fraction of stalks having ears or ear shoots on August 1. In the North Central States, the relationship is as shown in table 2. Kentucky and Virginia were included with the North Central States, rather than with the Southern States. The characteristics of the crop in these two States on each forecast date resemble the characteristics of the crop in the North Central region more closely than those of the crop in the Southern region.

Whenever the August 1 percentage of stalks with ears is low and ears have emerged in only a few fields, it seems preferable to assume a fixed number of ears per stalk (1.05 in the South or 0.98 in the North Central States), rather than to adjust the observed August 1 "ear" count as shown in table 2. In practice, it is desirable to consider fields in which no ears have yet emerged separately from those in which some ears have emerged. If there are fewer than 20 sample fields in the second group, table 2 fails to give a good indication of fruiting potential, even for the fields in that group.

It is preferable to apply the assumed average number of ears per stalk to the fields in both groups. But if ears have emerged in 20 or more

sample fields, the relationship in table 2 can be applied to data from this group to compute a current forecast of the average number of ears to be produced per stalk. This estimate can then be applied to the average stalk count for all fields in both groups.

The weight of grain produced per ear did not vary much from year to year during the period in which these studies were conducted. But a method of forecasting this weight early in the season is desirable. In much of the South, most ears have reached the milk stage, and their maximum length, by August 1. The length of the entire ear, or of the part of the ear that is covered by kernels, can then be used to predict the average weight of grain per ear at maturity. It is more convenient to measure the length of the entire cob over the husk. This procedure also avoids damage to the ear.

For ears that have reached their full length but are not ripe, the relationship between length of ear, measured over the husk, and weight of grain produced per ear is:

$$Y = 0.0854X - 0.304 \text{ ----- (1)}$$

In this equation, X is the total length of cob in inches, measured over the husk, and Y is the weight of grain produced in pounds, adjusted to 15.5 percent moisture content.

For ears that are already mature (maximum dry matter attained), the equation becomes:

$$Y = 0.0886X - 0.310 \text{ ----- (2)}$$

The difference in the two equations arises from the fact that ears shrink slightly as they ripen and become drier.

These relationships appear to be the same in the two regions of the country, and they are constant from year to year. But in a few Southern States and in most North Central States, ears have not yet reached their full length by August 1. In such instances, the weight of the grain must be predicted in some other way. There appears to be a relationship between the number of mature ears produced in 60 feet of row and weight of grain.

As the planting system in any area is relatively unchanged from one year to another, variations in ear counts reflect differences in growing conditions. Favorable growing conditions are conducive to good stands and the formation of large numbers of ears. These conditions are also conducive to good development of the ears. This

TABLE 3.—*Relation of weight of grain per 60 feet of row to number of ears with grain*

Ears with grain per 60 feet of row	Weight of grain at 15.5 percent moisture	
	North Central States	Southern States
<i>Number</i>	<i>Pounds</i>	<i>Pounds</i>
5.....	1.0	0.8
10.....	2.0	1.6
15.....	3.7	3.0
20.....	5.7	4.5
25.....	8.0	6.4
30.....	10.5	8.5
35.....	13.2	11.0
40.....	16.0	13.7
45.....	18.5	16.4
50.....	21.5	19.1
55.....	25.0	-----
60.....	28.2	-----
65.....	31.5	-----
70.....	34.8	-----

view is consistent with the behavior of other crops that have been studied in the research program on objective yield forecasting. The data in table 3 indicate that this is also true for corn.

As the number of mature ears expected can be forecast fairly well, this offers some chance of predicting the change in the quantity of grain to be produced per ear. The relationship is somewhat different in the North Central States (including Kentucky and Virginia) from that in the Southern region, as shown in table 3.

Table 3 could be used directly to forecast the weight of grain when the number of ears per 60 feet of row is known. But because the curve describing the relationship is at a different level in one location or State as compared with another, it is more accurate to use the table to indicate change from a previous year. If the number of mature ears per 60 feet of row and the weight of the grain are known for a previous year, the change in the weight of the grain associated with the change in the number of ears as indicated by table 3, can be applied to the grain weight for the previous year. This relationship has not yet been tested as extensively as those for other components of yield. But it is the only one that has been developed to date for forecasting the quantity of grain that will ultimately be produced by plants in such an immature stage of development.

Relationships for a September 1 Yield Forecast

By September 1 most of the ears that will produce grain are mature enough to be identified and counted. If a few fields have not reached the milk stage, the total number of mature ears expected can be predicted as for the August 1 forecast. But as a practical matter it is simpler, and just as satisfactory, to assume that the average number of ears per stalk-producing grain will be about the same for these fields as for the fields that are already more mature. The weight of the grain that will be produced can be estimated from the length of the cob, measured over the husk, as for the August 1 forecast.

A slightly more accurate indication can be obtained by considering only the length of the part of the cob that is covered by kernels. The average weight of grain per ear is related to this length by the equation:

$$X = 0.0890X - 0.215 \text{ ----- (3)}$$

As in equations (1) and (2), the weight per ear is in terms of pounds of grain at 15.5 percent moisture and the length of ear covered by kernels is measured in inches.

When fields are fully mature the sample ears can be weighed in the field, the shelled grain weighed in the laboratory, and moisture tests made. But even for such fields, ear-size measurements give an accurate weight indication much more quickly. In most States, the percentage of fields that have matured fully by September 1 is small. Even ears that look ripe may not have laid down all of the dry matter in the kernels.

The fraction of total dry matter already present in the kernels can be estimated from the ratio of dry kernel weight to wet kernel weight, as shown in table 4. This relationship is useful for forecasting the weight per ear at maturity or for adjusting grain weights when sample ears are harvested and weighed too early. It is also useful for estimating the reduction in yield caused by frost before ears reach full maturity. The data in the table are rounded average figures derived from laboratory studies at Iowa State College on a large number of sample ears from the North Central States during the last few years.

Table 4 gives the relationship between averages for large numbers of ears. Although any one ear for which the ratio of dry kernel weight to wet kernel weight is 70 percent has already laid down

all of its dry matter, any group of ears for which the average ratio is 70 percent must obviously include some ears for which the ratio is less than 70 percent. For this reason, the data in the table indicate a slightly different trend from one that would be observed in data for individual ears. But the trend shown in the table corresponds more closely to the way data are usually tabulated in practice.

Relationships for an October 1 Yield Forecast

By October 1 all dry kernel weight has been laid down in most southern fields. Weights of harvested sample ears or measurements of ear length give accurate indications of weight of grain per ear. In the North Central States, also most fields are fully mature. But in some of these States, the weight of grain per ear must often be estimated from ear-size measurements for half or more of the acreage. This estimate can be computed from the average amount of grain per inch observed in past years as reflected in equations (1), (2), and (3), or from the average amount of grain per inch observed in mature ears harvested currently.

A more accurate indication can be obtained by weighing sample ears and applying the relationship in table 4 to adjust the observed grain weight to a mature level. But if the production of dry matter is halted by a killing frost before the ears have a chance to reach maturity, an allowance must be made for the resulting reduction in yield. When the moisture content is known, table 4 can be used for this purpose.

Conclusion

Our discussion covers results obtained to date on the general problem of forecasting and measuring specific components of corn yield, in both the South and the North Central States, on August 1, September 1, and October 1. These results are now being applied on an experimental basis in the two regions. As experience accumulates, it is probable that the basic average relationships described in this report may need to be modified for groups of States, or possibly State by State, to make them apply more precisely to conditions existing in each individual State.

TABLE 4.—*Relationship between ratio of dry kernel weight to wet kernel weight and fraction of total dry matter laid down*

Average ratio of dry kernel weight to wet kernel weight	Average fraction of total dry matter laid down	Average ratio of dry kernel weight to wet kernel weight	Average fraction of total dry matter laid down
Percent	Percent	Percent	Percent
10.....	5	50.....	70
20.....	15	60.....	85
30.....	30	70.....	95
40.....	50	80.....	100

Procedures now being tested for making a yield forecast as of any forecast date can be summarized as follows:

1. If the crop is ready for harvest, count ears and apply the average weight of grain per ear, as derived from (a) harvesting sample ears and weighing the grain, or (b) measuring the length of sample ears and estimating the weight of the grain from the size of the mature ear.

2. If the crop is not ripe but ears have their maximum length (milk stage), count the ears and estimate the grain to be produced per ear from measured ear length.

3. If all ears are present but some have not reached maximum length, count the ears and forecast the average maximum length by (a) measuring ears that are in the milk stage, and/or apply table 3 to forecast ear size from the ear count.

4. If all ears are not yet present, forecast the total number to be formed (a) by applying an assumed average number of ears per stalk to the stalk count, or (b) by applying table 2 to get a current estimate of fruiting potential from fields that are already fruiting. Forecast ear size from the forecast of ear count.

5. In northern parts of some North Central States, the possibility of reduction in yield from frost must also be taken into account. Adjustment may be required for failure of ears to mature sufficiently to be harvested as grain, or for failure of the grain to reach its maximum dry weight even if it has matured sufficiently to be harvested as grain.

Book Reviews

Introduction to Mathematical Economics. By D. W. Bushaw and R. W. Clower. Richard D. Irwin, Inc., Homewood, Illinois. 345 pages. 1957. \$7.

IF I have a message to send, I prefer the telegraph to the wheelbarrow." This title page quotation from Emerson sets the tone for Bushaw and Clower's *Introduction to Mathematical Economics*. "Mathematics," said the American physicist Gibbs, "is a language." Bushaw and Clower add that it may therefore be taught as a language may be taught—by reading it, by speaking or writing it, and with minimum attention to grammar, syntax, and vocabulary.

The author's purpose ". . . is to provide an introductory account of mathematical methods of economics analysis which is accessible to persons with a limited training in mathematics." The method used to accomplish this purpose is one resembling the "Berlitz" method of teaching a foreign language. From the beginning, the student is given a text in the unfamiliar language. Information about the grammar, syntax, and vocabulary of mathematics is relegated to special sections at the end of the book.

The "reading" which the authors have chosen to present is a mathematical account of the modern theory of price determination. Macroeconomic statics and dynamics (market supply and demand) are discussed at length. Emphasis is placed on the distinction between pure flow models, pure stock models, and stock-flow models.

This emphasis is of recent vintage in the literature. It leads directly to dynamic considerations. These are discussed extensively with emphasis on the stability of macrodynamic models. The microeconomic theories of consumer and business behavior are discussed less fully, though adequately. Walrasian general equilibrium models are discussed only briefly.

The chapters on necessary mathematics take up slightly more than a third of the book. They include a terse and somewhat incomplete account of elementary calculus, determinants and quadratic forms, and difference and differential equations. The material on the stability of difference and differential equations is not really adequate

for a full appreciation of the problems involved, especially since such great emphasis is placed on this type of problem in the earlier discussion of macrodynamics.

Unfortunately, mathematics is not just a language; if it were, many of us would have an easier time with it. It is a complex logical structure of great abstraction. Translation from one language to another does not involve passing from one level of abstraction to another, but the application of mathematics to economics does. A reasonably full understanding of an area of mathematics is needed before the student can master the application of a theorem or two in economics. The extent and depth of the mathematical chapters in Bushaw and Clower are not sufficient to give the student a full appreciation of the application of mathematics to economics. Several courses in pure mathematics as well as some outside reading on more "esoteric" topics (such as the stability theory of differential equations¹) are needed.

Although the book will not serve as a good text for students who have had little or no mathematics beyond high school algebra, it will make an interesting and instructive text for students who have had mathematics through elementary differential equations. One semester course could be planned around the "reading" on the modern theory of price determination, with the suggestion that the student review the fundamental mathematics in the last third of the book on his own. If a second semester were planned, a series of topics taken from Allen's recent *Mathematical Economics* could be selected.

Whatever its shortcomings, this book is sure to stimulate interest in mathematical economics and in mathematics. If it encourages the student, who is mathematically ill-prepared, to pursue further studies in mathematics, it will have performed an exceedingly important function.

Marc Nerlove

¹ A good text is R. Bellman, *Stability Theory of Differential Equations*, McGraw-Hill, 1953.

THE SEARCH for eternal parameters that began with Pareto's universal formula for income distribution is carried forward impressively in this gargantuan production by Colin Clark. Perhaps best known popularly for his thesis that 25 percent of a nation's income devoted to taxes is a practicable maximum, Clark aspires to similar statistical verities arrived at by an encyclopedic compendium of national production, price, income, and other data for virtually all countries over a span of years that at times reaches back to the 19th century.

The proliferation of data allows the statistical analyses made to exceed in scope the wildest dreams of most day laborers in the field. For instance, a graphic regression of expenditure for farm products on real income uses data for 23 countries in two different time periods. Clark calls these "international and inter-temporal comparisons." Common units for his studies are an "International Unit" and an "Oriental Unit." The former, which was devised in 1937, is "... the quantity of goods exchangeable in the U.S.A. for \$1 over the average of the decade 1925-34." For various reasons, this unit is not satisfactory for comparisons that involve Oriental countries. The unit for them, the quantity of goods or services equivalent to one rupee in India in 1948-49, is further distinguished by being applied to productivity comparisons not per man-hour but "per head of the total population, per year." Such is Eastern timelessness!

From these analyses are obtained fundamental formulas such as those for food expenditure on real income—two in this instance, one derived from time series and one from international family budget data. (The latter is $Y = \frac{81x}{X+124}$) Also obtained are limiting values: The maximum percentage of the working force engaged in agriculture, forestry and fishing in the most undeveloped economy is 75 percent; the highest percentage of national product that can ever go to labor is 90 percent. And so on.

By no means all the results are so statistically precise. But nearly all are equally empirical. The entreaty of yesteryear to go forth and study the real world was never so faithfully observed as by

Colin Clark. He is an empiricist of extreme complexion.

A collection of integers and coefficients does not constitute economic theory, and the weakness of this book is its preponderance of data to the near exclusion of theoretical generalization. From so expansive a study, at least a few induced conclusions should be forthcoming. They are almost absent. Instead, only disconnected running comments are offered. Many are superficial and unsatisfactory, such as the one that the share of national income going to labor tends to increase "... with time, and as the wage earner's opportunities of obtaining capital, education and experience increase ..."

Virtual absence of systematic theory is all the more regrettable because the few threads that are present contain weighty thought. Among these are the implications of increasing returns, quoted from Clark's onetime tutor Allyn Young, which apparently were the stimulus to the book. A bugbear to Marshall, the enigma of increasing returns led to momentous advances in two directions, in the theory of imperfect competition (Sroffa, Jean Robinson, and many others), and in the theory of economic development. Students of development theory will do well to read Clark's excellent introduction to the second edition and the reference to Young that begins on page 343. Otherwise, conclusions from Clark's voluminous study are yet to be formulated. The title of the book itself is misleading. Instead of "Conditions" of economic progress, it should be "Chronicle" thereof.

But to admit disappointment in the lack of ready-made summing-up is not to disparage the value of the book as a source work. In both breadth and intricacy of detail it is astonishing. If you want to know the real income per person in Chile in 1941, the rate of increase in real product per man-hour per year in Portugal from 1914 to 1951, or the percentage of net income going to manufacture in Sweden in 1870, you will find them in Clark's book—they are 260 I. U., 0.8 percent, and 12.9 percent, respectively.

Without prejudice to Mr. Clark and equally with no intent of discouraging the use of his work for its wealth of data, reading it reminds one of Clifton Fadiman's classic quotation of a small

girl's review of a book packed with information on penguins: "This book tells me more about penguins than I am interested in knowing." Yet, notwithstanding the girl, whom Fadiman defended, and this overwhelmed reviewer, Clark's monu-

mental volume will serve for a long while as resource for the theory-making in the important area of economic development that he himself failed to achieve.

Harold F. Breimyer

A Concept of Agribusiness. By John H. Davis and Ray A. Goldberg. Graduate School of Business Administration, Harvard University. 136 pages. 1957. \$6.00.

SO CALLED FARM PROBLEMS presently confronting the food and fiber segment of the economy are agribusiness rather than agricultural in nature and scope and, therefore, such problems should be approached with agribusiness rather than agricultural perspective." This is the hypothesis that underlies the study—its *raison d'être*. The authors argue that the conventional entity "agriculture" is no longer appropriate for the purpose of assessing and improving policies related to food and fiber and that the broader concept is needed.

The term "agribusiness" denotes the sum total of all operations or economic activity involved in the manufacture and distribution of farm supplies. It includes production operations on the farm, and the storage, processing, and distribution of farm commodities and items made from them. One might term the concept one of an "integrated functional agriculture," encompassing all the inputs and outputs directly related to production and distribution of food and fiber.

A wide variety of data is used to illustrate the dimensions, magnitude, and flow of resources within the new entity and between it and the national economy. Some of the estimates are of limited reliability, and undoubtedly need further refinement, but all are useful in giving some idea of the relative scope of agribusiness. Yardsticks in terms of physical resources used, the size of the working force, and the value of output are developed to help the reader conceive of the major role of agribusiness in the total economy.

The authors' prime objectives in making the study are commendable. Certainly a better understanding of the existing relationships between the

on-farm and off-farm components of the entity is promoted by the statistical presentations. No doubt the new concept will help to suggest new approaches for improving policies relating to food and fiber. At any rate, with the new and broader frame of reference that the study suggests, hitherto overlooked implications of specific policies and programs will command the attention of analysts and policymakers.

Of particular interest to the reviewer is the chapter, "Agribusiness and the Future," in which the authors give a broad outline of an agribusiness approach to the solution of problems that confront the food and fiber sector of the economy. The authors assume the goals of agribusiness policy to be (1) economic stability geared to progress and to the optimum achievement of our national economic goals and (2) the shift of responsibility for such stability from Government to private sectors as rapidly as possible. To achieve these goals they stress the importance of integrated comprehensive research and the need for cooperation among the public administrators, farm organizations, commodity groups, business associations, and other spokesmen for agribusiness in formulating a comprehensive, well-defined, and well-balanced agribusiness policy. These, they maintain, "offer new hope of satisfactorily solving 'farm problems' in a manner consistent with American tradition and economic philosophy."

Researchers and technicians in the field of agriculture would do well to read this book, if only for the broader viewpoint it affords in definition and identification of this new entity of agribusiness.

Robert H. Masucci

The Federal Lands: Their Use and Management. By Marion Clawson and Burnell Held. The Johns Hopkins Press, Baltimore. 501 pages. 1957. \$8.50.

THE FEDERAL LANDS is the first book-sized product to be published by Resources for

the Future, a nonprofit corporation intended to advance development, conservation, and use of

natural resources, through research and education. The corporation was established in 1952 with the cooperation of the Ford Foundation, and its activities are financed by grants from that foundation. The book is a forward-looking piece that reflects the long experience of the senior author in western resource economics and his 5 years as Director of the Bureau of Land Management, plus the careful research that has gone into the study.

The authors examine briefly the question of whether the federal land will ever be disposed of and conclude that it will remain in federal ownership. This assumption is basic to their whole analysis. Assuming that our federal land is to stay in federal ownership, the authors review past history and trends in relation to future problems of management and suggest solutions for many of them. The history of federal lands and the place these lands occupy in the national economy today and may well occupy in the future are well summarized. The development of five major periods in the federal land-management policy of the Nation—acquisition, disposal, reservation, custodial management, and intensive management—give a useful background to their analysis.

A chapter that deals with uses of federal lands indicates the rapidly expanding overall use of these lands, the increased intensity of use, and the changing patterns of use in response to requirements. Another chapter discusses policy formation and decision making. It covers the role of pressure groups and the relation of local, State, and national interests in the formation of policies regarding federal lands and also the legislative and budgetary processes in relation to these lands.

The pricing processes and investments on federal lands are discussed in chapter 4. Here the authors stress the lack of competitive market forces in many phases of federal land management and the necessity of administrative decisions as one of the major problems. The mixture of competitive and administrative pricing for various uses of land complicates the whole federal land-management picture. The sharing of revenues with other federal programs and State and county govern-

ments may have an adverse effect on administration and development. For example, investment of federal funds in land improvement may bring a relatively small return to the federal treasury because of the sharing of any increased returns with these other units of government. This complicates the administrative decisions as well as the legislative decisions regarding investments on federal lands.

The authors' review and analysis of current problems are oriented to the future, and many of the trends are projected to 1980. Their analysis indicates that, since 1950, revenues from the use of public lands have exceeded expenditures. The total revenue from federal lands compares with the volume of business of some of the larger corporations. The need for intensive management of federal lands in the future brings up the question of how they should be managed.

Two plans are examined. One would provide for a federal land corporation that would take over the operation and management of all federal lands. The advantages and disadvantages of this device are thoroughly explored. An alternative would be to make changes in present management organizations, to achieve some of the advantages that might be had under a corporation form of management. The authors point out that one of the great needs of the future in federal land management is to join the best features of enlightened private business management with sound, tested features of public resource management. The latter must be extended to meet new demands imposed by the immensely greater uses made of the federal lands. The former are necessary in any conscious and explicit consideration of the financial aspects of federal land management today. The authors suggest that it is time to take a careful, critical, but imaginative, look at the problems of federal land management.

Agricultural economists will find in this book a new look at public land policies. They will find it well worth their time and enjoyably readable.

Harry A. Steele

The Growth of a Science: A Half-Century of Rural Sociological Research in the United States. By Edmund de S. Brunner. Harper and Brothers, New York. 171 pages. 1957. \$3.00.

WHEN A PIONEER and leading scholar in a discipline is inspired to chronicle and

evaluate its growth and progress, what he has to say must be heeded. This is especially true when

the discipline is young enough and the scholar old enough for them to have grown up together. Brunner confesses to being one of two young graduate students among 12 persons interested in rural sociology who gathered together for an informal meeting in 1912. From this meeting grew annual gatherings which eventually expanded into the Rural Sociological Society.

In the preface to his slender volume, Brunner outlines the problems faced in its completion: The considerable body of rural social research had to be reduced sufficiently for the publication resources available; studies had to be selected which portrayed fairly the research done at a given period on a given topic; and materials had to be organized under appropriate categories and presented in relation to the historical and topical organization decided upon.

Brunner isolates several influences or events in the pre-Purnell period which started rural sociology on its way. Among these were the appointment and reports of the Country Life Commission, 1908-09, the selection of "Rural Life" as the theme of the 1912 annual meeting of the American Sociological Society, the publication of three intensive studies of rural communities done under Giddings at Columbia University, and the work and personality of Charles J. Galpin, first of Wisconsin and later of the U. S. Department of Agriculture.

The first chapter is devoted to the pre-Purnell period of rural sociological research and the last is an appraisal of the methods and techniques, theory, contribution, and future of the discipline. These chapters are general in nature, and the remaining six are divided into major research topics wherein "representative" studies are discussed. In his topical discussions, Brunner traces the development and increasing sophistication of studies and classifies them according to type. He also reviews definitions and theory and summarizes major findings. This is a real service to the busy scholar.

It is logical that the author should begin with

an appraisal of community studies and follow with a review of population research, for these are the most popular research areas in rural sociology. A review of studies of the major social institutions precedes a discussion of research in rural social organization. Of special interest to agricultural economists is a chapter that treats sociological research on farm tenancy, farm labor, human factors in successful farming, part-time farming, mechanization, and cooperatives. A final topical theme is regionalism, suburbanism, trends, and values.

Brunner concludes that the total development of rural sociology is impressive and he summarizes the contribution of the discipline as follows: "It has brought an understanding of the rural community, its institutions, organizations, and groups. It has been responsible for improved demographic analysis of the characteristics of rural people. It has established the importance of human and social elements in gaining acceptance for agricultural improvements. Its analyses of culture, cliques, groups, and other collective phenomena have helped greatly in the effectiveness of action programs and in the improvement of established institutions. It has begun usefully to explore the opinions, attitudes, and values of rural people and to describe the communication processes among them. And among other contributions it has shared its knowledge and personnel for 30 years with countries in every continent."

In a work that is highly selective and has not addressed itself necessarily to the best studies in the field, one may look in vain for certain studies he considers classic. To this extent, some readers will be disappointed in Brunner's treatment. Some readers will feel also that certain topics have been overplayed at the expense of more deserving ones. But the inevitable general conclusion must be that this is a volume that has a rightful place on the bookshelf of every social scientist.

Alvin L. Bertrand

Selected Recent Research Publications in Agricultural Economics Issued by the United States Department of Agriculture and Cooperatively by the State Colleges

ANDERSON, K. E. THE SPECIAL MILK PROGRAM. ITS EFFECT ON CONSUMPTION IN ST. LOUIS AND LOS ANGELES SCHOOLS. U. S. Dept. Agr. Mktg. Res. Rpt. 209, 45 pp. January 1958.

Marked increases took place in the average daily milk consumption per pupil in St. Louis and Los Angeles public schools serving milk after introduction of the Special Milk Program in 1955. This report analyzes the effect of this program on milk consumption in elementary and

secondary schools in both cities in the 1954-55 and 1955-56 school years.

BERTRAND, A. L. TRENDS AND PATTERNS IN LEVELS OF LIVING OF FARM FAMILIES IN THE UNITED STATES. U. S. Dept. Agr. Agr. Inform. Bul. 181, 21 pp., illus. February 1958.

Farm-operator families in the United States in recent years have rapidly improved their level of living. In 1956, almost all farm families had electricity and mechanical refrigeration and three-fourths owned automobiles. This study brings to date information on trends and regional variation in farmers' ownership and utilization of certain level-of-living items, and shows the association of such factors as tenure, age, and education of farm operators and farm family income to levels of living.

BREWSTER, J. M. FARM RESOURCES NEEDED FOR SPECIFIED INCOME LEVELS. U. S. Dept. Agr. Agr. Inform. Bul. 180, 67 pp., illus. Dec. 1957.

Findings deal with the amounts of land and other resources needed by farmers to combine with their labor and management to obtain levels of earnings similar to those of semiskilled and skilled workers in nonfarm employment, in six areas and as many different types of farms—cotton-beef farms, Piedmont of South Carolina; dairy-cotton farms, western Tennessee; cotton farms, eastern Oklahoma; dairy farms, eastern Wisconsin; wheat-beef farms, Central Plains, Kansas; and wheat farms, Triangle-Judith Basin, Montana.

BRIGHT, IMOGENE. THE WAGE FACTOR IN RETAILING MEAT IN 4 CITIES. U. S. Dept. Agr. Mktg. Res. Rpt. 202, 40 pp., illus. November 1957.

Report attempts to explain and evaluate the variations in the wage bills for retailing meat. Wage rates, which to some extent determine labor costs, vary and have been increasing. In this survey of meat departments of selected food stores in 4 cities, employment practices and direct wage payments were studied.

CONLOGUE, R. M. MARKETING COSTS AND MARGINS FOR CHICKEN FRYERS AND FOWL SOLD IN CHICAGO AND MINNEAPOLIS-ST. PAUL. U. S. Dept. Agr. Mktg. Res. Rpt. 195, 31 pp., illus. November 1957.

This study describes the 1955-56 margins and operating costs of processors of chicken fryers and fowl shipping into the Chicago and Minneapolis-St. Paul areas; the margins and costs of poultry wholesalers, and the margins of chain and independent retailers in these areas.

COTTON, R. T. INSECT CONTROL IN FLOUR MILLS. U. S. Dept. Agr. Agr. Handb. 133, 28 pp., illus. February 1958.

This handbook suggests procedures and provides information on how to prevent insect infestation in flour mills. Information covers fumigation methods and other treatments, sources of infestation, insects infesting the grain, and how to detect infestation.

DAVIS, L. H. MARKETING ASPECTS OF FATTENING LAMBS IN COLORADO, IDAHO, MONTANA, NEW MEXICO, AND UTAH. Utah Agr. Expt. Sta. Bul. 402, 23 pp., illus. (In cooperation with Agr. Expt.

Stas. of the Western States and the U. S. Dept. Agr.) A Western Reg. Res. Pub. November 1957.

About 65 percent of the lambs fattened in the United States are fattened in western areas. This report describes the western lamb fattening areas and analyzes and presents data on procurement of lambs for fattening and marketing of lambs for slaughter.

DOTY, H. O., JR. LAMB AVAILABILITY AND MERCHANDISING IN RETAIL STORES. U. S. Dept. Agr. Mktg. Res. Rpt. 207, 40 pp., illus. January 1958.

A national survey gives an overall picture of lamb availability in the Nation's retail food stores during one week in October 1955. Here are results of this survey—comparisons of important elements in the retailing of lamb by regions, by size of city, and by kind, size, and management of stores.

ENOCHIAN, R. V., SMITH, F. J., AND SAMMET, L. L. COST AND EFFICIENCY IN HOUSE PACKING WESTERN HEAD LETTUCE. Calif. Agr. Expt. Sta. Mimeo Rpt. 199, 65 pp., illus. September 1957.

Since 1952, there has been a rapid changeover from house packing of lettuce to field packing. The shippers face the problem of how to use the excess capacity in house-packing facilities, created by this shift, most economically. Report studies the problems in this changeover—costs, machinery needed, crews needed, and operations performed.

GERALD, J. O., AND PRITCHARD, N. T. PRICING EGGS AT WHOLESALE IN NEW YORK CITY. U. S. Dept. Agr. Mktg. Res. Rpt. 210, 31 pp., illus. January 1958.

Explains the structure of the New York City egg market and the changes it is undergoing. Prices for eggs established in New York are believed to influence considerably the prices paid farmers throughout large parts of the United States. This report evaluates the pricing mechanism and indicates possible means of overcoming its shortcomings.

GREGORY, W. F. SILAGE MAKING COSTS AND PRACTICES. REPORT OF A 1954-55 STUDY OF EXPERIENCES OF FARMERS IN FOUR ALABAMA COUNTIES. Ala. Agr. Expt. Sta. Bul. 310, 29 pp., illus. December 1957.

For farms in the study, the average cost of harvesting, storing, and feeding a ton of silage was \$3.93 for trench silos and \$5.18 for upright silos.

HANSING, F. D. FINANCING THE PRODUCTION OF BROILERS IN LOWER DELAWARE. Del. Agr. Expt. Sta. Bul. 322. October 1957.

About two-thirds of the broilers grown in lower Delaware in 1955 were produced under contracts with feed dealers. Nearly 85 percent of the approximately \$5.5 million investment in housing and equipment was made by the contracting dealers, who provided chicks, feed, and other supplies needed by the contract growers as well as those needed for their own production.

HENDERSON, H. A. PASTURES AND PASTURE PRACTICES. PASTURES ON HAYWOOD COUNTY, TENNESSEE, FARMS—HOW THEY WERE PRODUCED AND

USED. Tenn. Agr. Expt. Sta. Bul. 272 14 pp., illus. September 1957.

A survey of 24 livestock farms with some improved pasture showed that 168 acres were grazed on the average farm in the sample; 72 of these acres were in perennial pasture, with 29 acres improved. Many of these farmers were not following practices recommended by the College of Agriculture for establishing and maintaining improved pastures. Whether their pastures would be adequate depended on the weather.

IBACH, D. B. SUBSTITUTING FERTILIZER FOR LAND IN GROWING CORN. U. S. Dept. Agr. A R S 43-63, 16 pp., illus. November 1957.

This publication points out that considerably higher rates of application of fertilizer would be profitable on most farms in the main corn-producing areas. In the Corn Belt, at the projected crop-fertilizer cost relationships used in this analysis, rates per acre could be increased nearly threefold before passing the point of minimum total cost of production per bushel.

LEVINE, D. B. HOMEMAKERS APPRAISE FIBERS FOR SELECTED ITEMS OF HOUSEHOLD FURNISHINGS; PRELIMINARY SUMMARY REPORT. U. S. Dept. Agr. AMS-220, 14 pp. January 1958.

In this preliminary report, some of the major findings relating to homemakers' ownership of and attitudes toward the different fibers used in selected items of household furnishings are presented. A final detailed report is in preparation.

LUTZ, J. M., FINDLEN, HERBERT, AND KAUFMAN, JACOB. OPERATING FANS IN CARS OF PRODUCE ARRIVAL AT TERMINAL MARKETS. U. S. Dept. Agr. Mkt. Res. Rpt. 206, 9 pp., illus. November 1957.

Operating permanently installed fans in cars to maintain desirable temperatures in perishable fruits and vegetables while the cars stand on track at terminal markets help avoid excessively high temperatures in the top and dangerously low temperatures at the bottom of the car. Results of tests conducted in 1954, 1956, and 1957 are given.

MATHIS A. G. THE PROBABLE IMPACT OF MILK CONCENTRATES ON THE FLUID MILK MARKET. U. S. Dept. Agr. Mktg. Res. Rpt. 208, 24 pp., illus. February 1958.

Concentrated milk will probably not displace a major part of fresh fluid milk. Acceptance of new concentrated milk products will depend largely on the price advantage consumers can obtain to offset real or fancied inconveniences. Price, costs, consumer acceptance, and different forms of concentrated milk are studied.

MYERS, K H. ANALYSIS OF GRASSLAND FARMING IN NORTHEASTERN PENNSYLVANIA. Pa. Agr. Expt. Sta. Bul. 627, 18 pp., illus. December 1957.

It is estimated that adoption of improved practices alone will almost double the income on a typical farm in this area. An all-grassland cropping plan will further increase the income about 37 percent if the dairy herd is so expanded that the additional forage is consumed on the farm. Little change in income will result if the additional forage is sold as hay. Both labor requirements and capital investment will increase, with enlargement

of the dairy enterprise, about 20 and 22 percent, respectively.

POATS, F. J., AND FONG, WILLIE. ECONOMIC EVALUATION OF COLOR IN DOMESTIC WOOL. U. S. Dept. Agr. Mktg. Res. Rpt. 204, 35 pp., illus. November 1957.

Producers and processors of wool are here given the results of research investigations on non-scourable color in wool. Research objectively measures degrees of color defect found in a cross-section of domestic wool and evaluates the economic effects, primarily marketability and price differentials associated with varying intensities of color in wool found by the physical measurements.

POHLE, E. M., JOHNSTON, D. D., KELLER, H. R., AND OTHERS. VALUE-DETERMINING PHYSICAL PROPERTIES AND CHARACTERISTICS OF DOMESTIC WOOLS. U. S. Dept. Agr. Mktg. Res. Rpt. 211, 67 pp., illus. February 1958.

Studies the accuracy of visual appraisals for wool grades, for clean wool yield, and for staple length; also tests the accuracy of sampling and testing methods used to estimate grade and yield.

REED, R. H. SURVEY OF THE PACIFIC COAST FROZEN FRUIT AND VEGETABLE PROCESSING INDUSTRY. Calif. Agr. Expt. Sta. Mimeo. Rpt. 198, 36 pp., illus. September 1957.

Reports plans, organization and efficiency, different operations involved in moving the product to market and methods of handling and preparing fruits. Studies relationships among demand, supplies, and prices of selected types and forms of deciduous fruits and vegetables.

ROY, E. P. EGG MARKETING BY COMMERCIAL PRODUCERS IN THE SOUTH. (Agr. Expt. Stas. of Ala., Ark., Ga., La., Miss., N. C., P. R., S. C., Tenn., Tex., and Va., in cooperation with the U. S. Dept. Agr.) Southern Coop. Ser. Bul. 50, 100 pp., illus. June 1957.

The 10 Southern States constitute a deficit area in table eggs relative to production and consumption levels existing during 1954. This study ascertains the status and problems associated with commercial egg operations in the South.

SITLER, H. G. ECONOMIC POSSIBILITIES OF SEEDING WHEATLAND TO GRASS IN EASTERN COLORADO. U. S. Dept. Agr. ARS 43-64, 39 pp., illus. February 1958.

Farmers here have been more successful in establishing grass on sandy than on heavy lands. From 3 to 6 years are needed to obtain a usable stand of grass and reseeding is often necessary. Expenses during this period are heavy and little or no income is received from the land. The Agricultural Conservation Program provides cost-share assistance to about 50 percent of the cost with a limit of about \$5 an acre for approved practices. Report shows that with the facts, assumptions, and examples set forth, maximum net income is obtained when all land yielding 5 bushels or less of wheat per acre is used as seeded pasture for summer yearlings. This assumes expenses similar to those in 1954 and wheat at \$1.70 a bushel, and that stock water is available.

STANTON, J. R., AND MOUNT, R. R. LEVELS OF LIVING OF U. S. FARM FAMILIES, SELECTED ANNOTATED REFERENCES, 1940-1955. U. S. Dept. Agr. Misc. Pub. 746, 53 pp., November 1957.

List of references is limited to publications that describe or analyze the content of family living, the measurement of levels of living through indexes or socio-economic scales, farm family living expenditures, or rural housing and home conveniences.

U. S. AGRICULTURAL MARKETING SERVICE. COMPILATION OF STATUTES RELATING TO MARKETING ACTIVITIES, INCLUDING RESEARCH, SERVICE, AND REGULATORY WORK OF THE AGRICULTURAL MARKETING SERVICE. U. S. Dept. Agr. Agr. Handb. 130, 210 pp. January 1958.

U. S. AGRICULTURAL MARKETING SERVICE. CONTROLLING INSECT PESTS OF STORED RICE. U. S. Dept. Agr. Agr. Handb. 129, 30 pp., illus. October 1957.

Climate in Gulf States and California where rice is grown favors the rapid increase of insect pests in stored rice. Strict sanitation on the farm, in elevators, warehouses, and mills, and storage of rough and milled rice in structure tight enough for fumigation can do much to prevent serious losses from insect attack. Handbook discusses best methods of protection against insects and fumigants found effective in treating stored rice, and describes new and more efficient methods of fumigating rice.

U. S. AGRICULTURAL MARKETING SERVICE. FARM-RETAIL SPREADS FOR FOOD PRODUCTS, COSTS, PRICES. U. S. Dept. Agr. Misc. Pub. 741, 175 pp., illus. November 1957.

Report covers farm-retail spreads for various products and the farmers' share in the marketing bill; it describes sources of data and methods of calculation. The farm-retail spread is the difference between the retail price of a product and its farm value—the payment (adjusted for byproduct values) to farmers for an equivalent quantity of farm products.

U. S. AGRICULTURAL MARKETING SERVICE AND AGRICULTURAL RESEARCH SERVICE. FOOD PRODUCTION FOR HOME USE BY HOUSEHOLDS IN THE UNITED STATES—BY REGIONS. U. S. Dept. Agr. Household Food Consumption Survey 1955, Rpt. 12, 88 pp., illus. January 1958.

The 12th in a series on food consumption and dietary levels of households, this report covers the production of food—vegetables, meats, dairy products, eggs—for home use. It is based on a national probability sample of approximately 6,000 housekeeping households. Fifteen tables, for the United States and each region, summarize the percentage of households (urban, rural nonfarm, and rural farm) that produced food in 1954 for their own use, money value of home-produced foods, freezing facilities for these foods, canning of home-produced foods, quantity used fresh, and storage of home-produced vegetables.

U. S. AGRICULTURAL RESEARCH SERVICE. EFFECTS OF ACREAGE-ALLOTMENT PROGRAMS, 1954-1955. A DETAILED ANALYSIS FOR SELECTED CROPS AND AREAS. U. S. Dept. Agr. ARS 43-47, 150 pp., illus. December 1957.

Acreage-allotment, marketing-quota, and associated price-support programs in effect during the last 2 years were generally successful in restraining the production and promoting more orderly marketing of the "basic" crops. But the 8-percent reduction from 1953 to 1955 in cotton, wheat, corn, and rice was more than offset by increases in production of nonallotment crops, mainly feed grains other than corn, oilseed crops, rye, and hay.

U. S. DEPARTMENT OF AGRICULTURE. MAJOR STATISTICAL SERIES OF THE U. S. DEPARTMENT OF AGRICULTURE. HOW THEY ARE CONSTRUCTED AND USED. Agr. Handb. 118.

GROVE, E. W., CANNON, M. F., MASUCCI, R. H., AND GOODSSELL, W. D. Agr. Handb. 118, vol. 3, 106 pp. December 1957.

SMITH, R. K., AND WALKER, H. R. CROP AND LIVESTOCK ESTIMATES. Agr. Handb. 118, vol. 8, 24 pp. October 1957.

This series of reports is designed as a reference on statistics of the U. S. Department of Agriculture. It describes the major statistical series, discusses their uses, and compares them with related series published by the USDA or other agencies of the U. S. Government.

VAN ARSDALL, R. N., AND CLEAVER, THAYER. LESS LABOR IN EGG PRODUCTION. Ill. Agr. Col. Ext. Cir. 785, 32 pp., illus. December 1957.

Many poultrymen in Illinois need to use more and improved mechanical equipment to take over some of the chore work on laying flocks. But some of this equipment is not economical for flocks below a certain size. Among the types of equipment are mechanical feeders, immersion-type mechanical washers, wire cages (which are still experimental), and automatic watering. Plans are given for laying-house arrangements designed for flocks of different sizes.

WEIDENHAMER, MARGARET. HOMEMAKERS' USE OF AND OPINIONS ABOUT PEANUTS AND TREE NUTS. U. S. Dept. Agr. Mktg. Res. Rpt. 203, 100 pp. November 1957.

The trend in the production of peanuts has been upward. In general, consumption has not kept pace with production, and surpluses of some types of edible peanuts have occurred. The pattern of production and consumption of domestic tree nuts is similar to that of peanuts. Report summarizes results of a study of homemakers' use of and opinions about peanut and tree-nut products.

WHITEMAN, T. M. FREEZING POINTS OF FRUITS, VEGETABLES, AND FLORIST STOCKS. U. S. Dept. Agr. Mktg. Res. Rpt. 196, 32 pp., illus. December 1957.

Freezing points were determined for the principal fruits, vegetables, and florist stocks. Data provide a guide that growers, shippers, storage operators, and others can use to minimize or avoid freezing damage and losses.

**AGRICULTURAL ECONOMICS
RESEARCH**

Is published quarterly by the Agricultural Marketing Service, U. S. Department of Agriculture. The printing of this publication has been approved by the Bureau of the Budget, Feb. 8, 1956.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 20 cents a single copy, 75 cents a year, domestic, \$1 foreign.